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Research Article

Portal track infiltration versus Interscalene brachial plexus block for Pain control following shoulder arthroscopy

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KEYWORDS

Shoulder arthroscopy;
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Abstract Arthroscopic shoulder surgery is often associated with severe postoperative pain that can be difficult to manage without large-dose opioids [1,2].
Local anaesthetics can also be injected into joint spaces to provide analgesia during and after arthroscopic surgery [3].
The goal of the present study was to assess the efficacy of the portal track infiltration versus interscalene block on adequacy of pain control, and possible side effects.
Methods: Sixty patients of ASA I or II patients, presenting for arthroscopic subacromial decompression, were included in this comparative randomized study.
Group I received preincisional 30 ml of bupivacaine 0.5% using spinal needle 22G at the site of insertion of the trocars, 10 ml at each trocars site. Group II received interscalene block using the same equal amount of 30 ml bupivacaine 0.5% at the start of the procedure before general anaesthesia using electric nerve stimulator. Visual analogue scale (VAS), time to first need of analgesia in each group, total amount of analgesia and the occurrence of side effects necessitating overnight hospital stay were recorded.
Results: There was significant reduction of heart rate and mean blood pressure in group II compared to group I from 15 min onwards.
VAS readings were insignificant between the two groups in the first 9 h postoperatively.

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As regards the timing of first requirement of analgesics and total amount of analgesia required in the first 24 h, and the complications necessitating overnight stay, the readings were insignificant in both groups.

Conclusion: This denotes that pre-emptive analgesia offered using portal track infiltration not only gives equipotent analgesia to that of the interscalene, but lacks significant risks and can be easily to give by the surgeon.

1. Introduction

Arthroscopic shoulder surgery is associated with significant postoperative pain that can be difficult to manage without the use of large-dose opioids [1,2]. Supplementing general anaesthesia (GA) with a regional nerve block improved the quality of postoperative pain relief [3].

The adequacy of postoperative pain control is one of the most important factors in determining whether a patient can be safely discharged from the outpatient facility [4]. Preincisional local anaesthetics block the sensitization of peripheral nociceptors and reduce hyperexcitability. This technique provides better pain relief than using the same drugs in the postoperative period [5].

Despite a trend towards the use of regional anaesthesia for orthopaedic procedures, there has been resistance to the use of interscalene regional block for shoulder surgery because of concerns about failed blocks and potential complications. However, the use of nerve stimulator as a guide to the brachial plexus would increase the rate of success and minimizes complications [2,6].

Local anaesthetics can also be injected into joint spaces to provide analgesia during and after arthroscopic surgery [7]. Intraarticular instillation of 30 ml of 0.5% bupivacaine reduced the opioid requirements and facilitated early mobilization and discharge after knee arthroscopy [8].

The goal of the present study was to assess the efficacy of the portal track infiltration versus interscalene block on adequacy of pain control and possible side effects.

2. Methods

Patients presenting for arthroscopic subacromial decompression due to shoulder impingement were the target of the study. Sixty patients of ASA I or II classification aged 30-60 years were included in the research during the specified time of the study. The study started at January 2011 to December 2011. The study adopted a comparative randomized approach.

The exclusion criteria were ASA III patients, hypertensive, diabetic patients with peripheral neuropathy, coagulation abnormalities, any contraindication to interscalene, or patients presenting for operation other than shoulder impingement. After obtaining an approval from ethical committee, an informed written consent was obtained from every patient. Patients were assigned randomly to one of two groups, each group of thirty patients. First case was randomly allocated to either group using simple random technique. Successive cases were systematically allocated to both groups successively.

Group I patients received intravenous sedation using midazolam 1 mg and 100 μg fentanyl after applying standard monitoring and intravenous line insertion. Moreover, patients received preincisional 30 ml of bupivacaine 0.5% using spinal needle 22G at the site of insertion of the trocars,10 ml at each site after careful aspiration and over one minute (lateral port into the subacromial space, posterior port at 2 cm down and 1 cm medial to the acromial angle, and anterior port at the rotator interval). This was followed by induction of general anaesthesia using fentanyl 1 μg/kg, propofol 1–2 mg/kg, and cisatracurium at a dose of 0.15 mg/kg.

Group II received interscalene block using same equal amount of 30 ml bupivacaine 0.5% at the start of the procedure before general anaesthesia by means of an electric nerve stimulator (B-Braun, Germany), giving the volume using insulated needle. The needle was attached via extension tubing to a syringe containing the local anesthetic agent. Needle was slowly advanced until the fascial sheath was penetrated. Observing deltoid twitches was an indicator for injection which was proceeded at less than 0.5 mA. Twenty minutes later, following general anaesthesia induction, endotracheal tube insertion, patient positioning, and trocars insertion were done thus arthroscopy proceeded. Heart rate and mean blood pressure were recorded every five minutes throughout the procedure, starting with a baseline preoperative reading. Visual analogue scale (VAS) was recorded postoperatively on 3 h intervals till 12 h. Then, telephone follow up was used to assess VAS after discharge from hospital during the next 12 h.Time to first need of analgesia in each group and total amount of analgesia needed were recorded. Postoperative analgesia composed of nalbuphine given intravenously in a dose of 0.05 mg/kg, and repeated till V.A.S decreases to less than 3, denoting adequate pain control and patient satisfaction. Occurrence of complications due to interscalene block, or postoperative persistent pain necessitating overnight hospital stay was recorded.

2.1. Statistical analysis of data

Raw data were coded and transformed into coding sheets. The results were checked. Then, the data were entered into SPSS system files (SPSS package version 18) using personal computer. Output drafts were checked against the revised coded data for typing and spelling mistakes. Finally, analysis and interpretation of data were conducted.

The following statistical measures were used:

Table 1 Age of the studied groups of patients.

Age (years)	Group I (n = 30)	Group II (n = 30)	Significance
Min–Max	32–60	37–59	t = 0.869
Mean ± SD	49.2 ± 8.3	47.4 ± 7.5	P = 0.388

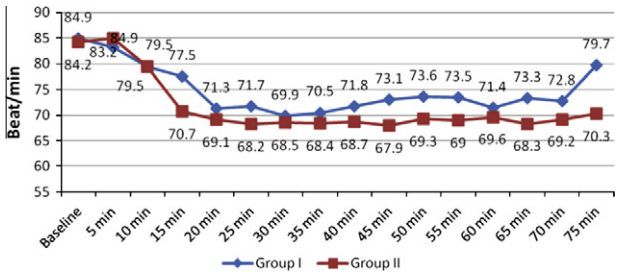

Figure 1 Heart rate of the studied groups of patients at different timing recorded intra-operatively.

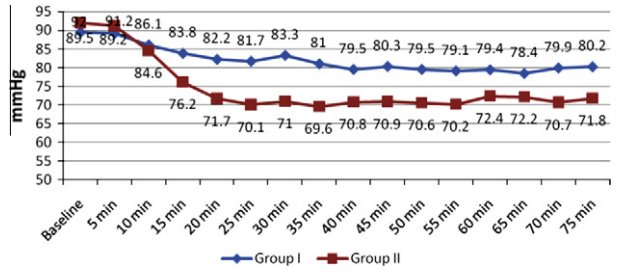

Figure 2 Mean blood pressure of the studied groups of patients at different timing recorded intra-operatively.

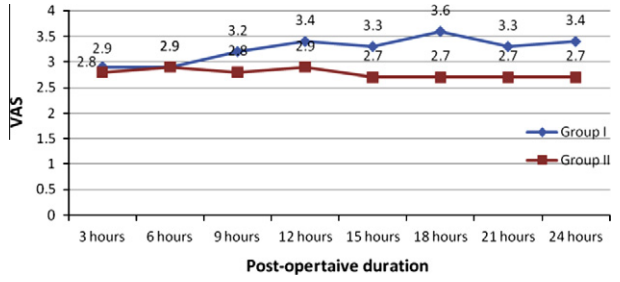

Figure 3 Visual analogue scale of the studied groups of patients at different timing recorded during post-operative period.

- Descriptive statistics including frequency, distribution, mean, and standard deviation were used to describe different characteristics.
- Kolmogorov – Smirnov test was used to examine the normality of data distribution.
- Univariate analyses including: t-test and Mann Whitney test were used to test the significance of results of quantitative variables. Monte Carlo test and Yates corrected Chi-Square test were used to test the significance of results of qualitative variables.
- The significance of the results was at the 5% level of significance.

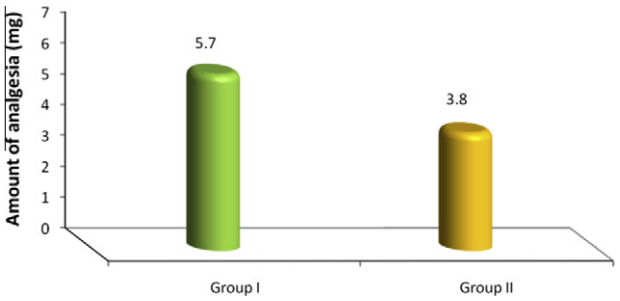

Figure 4 Amount of analgesia needed by patients of the studied groups during post-operative period.

3.Results

This study was carried out on 60 ASA I–II patients. Patients were randomly categorized into two groups each of 30. Age of the studied patients in group I ranged between 32 and 60 years with a mean of 49.2 ± 8.2 years. Group II patients had their age ranging between 37 and 59 with a mean of 47.4 ± 7.5 years. There was no significant difference between the two groups regarding the age (Table 1).

Intraoperatively, in group I, patients had a baseline heart rate with a mean of 84.9 ± 8.7 beats, and in group II was 84.2 ± 7.2 with no significant difference between the two groups. There was a significant reduction of the heart rate at 15 min ($P = 0.001$), 25 min ($P = 0.016$), 45 min ($P = 0.008$), 50 min ($P = 0.047$), 55 min (0.003), 65 min (0.002), 70 min (0.022) and 75 min (< 0.0001) following interscalene block in group two, compared to group one (Fig. 1).

Regarding the mean blood pressure measured intraoperatively, the baseline reading in group I was 89.5 ± 5.2 compared to 92.0 ± 5.1 in group II with no significant difference between the two groups. Starting 15 min onwards, there was significant reduction in the mean blood pressure in group II (interscalene), compared to group I (Fig. 2).

Table 2 Timing and amount of analgesia needed by patients of the studied groups during post-operative period.

Analgesia	Group I ($n = 30$)		Group II ($n = 30$)		Significance
	No.	%	No.	%	
Timing of first needed analgesia					
Immediately post-operative	5	16.7	0	0.0	$P = 0.135$[a]
After 6 h	2	6.6	2	6.6	
After 12 h	5	16.7	8	26.7	
Not needed for 24 h	18	60.0	20	66.7	
Amount of analgesia needed (mg)	($n = 12$)		($n = 10$)		
Min–Max	2–10		2–6		$Z = 1.814$
Mean ± SD	5.7 ± 2.5		3.8 ± 1.5		$P = 0.07$

[a] P: Monte Carlo test. Z: Mann Whitney test.

Table 3 Occurrence of complications that necessitate overnight hospital stay among the studied groups of patients.

Occurrence of complications	Group I ($n = 30$)		Group II ($n = 30$)		Significance
	No.	%	No.	%	
Present	4	13.3	3	10.0	$X^2 = 0.0$[a]
Absent	26	86.7	27	90.0	$P = 1.0$

[a] X^2: Yates corrected Chi-Square.

Postoperatively, visual analogue scale (VAS) had insignificant readings at 3, 6 and 9 h. However, it was significantly less (VAS < 3) in group II compared to group I at 12, 15, 18, 21 and 24 h. However, VAS had readings less than 4 (tolerable pain) in group I in the first 24 h (Fig. 3).

As regards the timing of first requirement of analgesics and total amount of analgesia required in the first 24 h, the readings were insignificant in both groups (Table 2, Fig. 4).

As regards occurrence of complications that necessitated overnight hospital stay, four patients in group I (portal track infiltration), compared to three out of 30 in group II, with insignificant differences between both groups (Table 3).

4. Discussion

Sympathectomy due to interscalene block is responsible for the significant reduction of heart rate and mean blood pressure in most measured times intraoperatively. The sympathetic block, combined with general anaesthesia and beach chair position, provides hypotensive anaesthesia needed during shoulder arthroscopic interventions for better field visualization and optimum working conditions. However, hypotensive bradycardia episodes (HBE) and even cardiac arrest are potential risks [9,10].

In the portal track group, although the mean blood pressure was significantly reduced in group I (portal track) compared to group II (interscalene), but the Intraoperative circumstances regarding field visualization and optimum working conditions were the same as in second group. This can be explained by reduced stress response by the adequate pre-emptive analgesia, general anaesthesia and beach chair position leading to the stability and even slight reduction of the heart rate and mean blood pressure following trocars insertion.

As regards mean VAS, in the first 9 h postoperatively, there was no significant difference between the two groups. However, pain score was significantly lower in the interscalene group (group II), compared to portal track group (group I) starting from 12 h onwards postoperatively. However, the first time to require analgesia, total amount of analgesia consumed in the first 24 h, results between both groups were insignificant. Another important finding was that in all measured times VAS was less than 4 in group I and less than 3 in group II.

In agreement with our results, Kim et al. showed that the interscalene block group showed a significantly lower VAS score postoperatively [11]. In agreement with our results is Fontana et al. who showed better VAS results with intraarticular and subacromial infiltration compared to subacromial or intraarticular alone [12]. However, Webb et al. found no statistically significant difference between continuous subacromial infusion of bupivacaine versus interscalene block regarding VAS, or rescue medication use [13].

However, four patients (7.5%) in group I had to stay overnight to treat pain (VAS $\geqslant$ 5). Pain scores decreased following intravenous analgesia. In group II, two patients stayed overnight due to persistent numbness in the upper limb that lasted for 24 h with no intervention. The causes of injury or palsy are usually direct trauma, excessive stretching of the plexus from external pressures or combination of these [14]. Direct nerve trauma may occur during proximal brachial plexus block as these blocks have the highest incidence (1–6%) of neurological complications [15]. One patient had immediate postoperative ptosis that also was relieved spontaneously. It is common to develop ptosis after interscalene as a part of Horner syndrome [16].

This denotes that pre-emptive analgesia offered using portal track infiltration not only gives equipotent analgesia to that of the interscalene, but also lacks significant risks and has the advantage of being easy to give by the surgeon. Also portal track infiltration would give optimum working conditions intraoperatively.

In conclusion, Portal track infiltration provides equipotent analgesia to interscalene brachial plexus block with less significant risks. Moreover it provides optimum Intraoperative working conditions.

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